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ABSTRACT

The recent development of strong statistical techniques has made accurate predictions of recidivism possible. To investigate the utility of discriminant analysis methodology in making predictions of recidivism in juvenile offenders, the court records of 271 male and female juvenile offenders, aged 12-16, were reviewed. A cross validation group (N=43) was randomly selected from the original sample. Cases were selected for inclusion based on age of less than 17 at the time of evaluation; evaluation battery which included at least the mini-mult form of the Minnesota Multiphasic Personality Inventory (MMPI), either the Wechsler Intelligence Scale for Children--Revised (WISC-R) or the Wechsler Adult Intelligence Scale (WAIS); and Full Scale Intelligence of at least 70. The 12 discriminant variables which were examined represented demographic, economic, educational, legal, and personality indices. Discriminant analysis was performed on the entire sample at the end of a 12-month follow-up period (analysis 1), and again at the end of the same follow-up period (analysis 2) on that portion of the sample not placed in a residential setting following evaluation. Results showed that both of the derived discriminant functions were able to predict recidivism at better than the established change level. The factors which proved to be important in the prediction of recidivism were the D and K scales (which measure depression, guilt, openness and trust) from the mini-multi MMPI and prior criminality, particularly the seriousness of that record. (BL)

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Prediction of Recidivism in Juvenile Offenders Based on Discriminant Analysis

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Abstract

Prediction of Recidivism in Juvenile Offenders
Based on Discriminant Analysis

Efforts to use psychological and demographic variables to predict recidivism in juvenile offenders are now quite well-established. These efforts, however, have been inconclusive and contradictory. The development of stronger statistical techniques has made accurate prediction of recidivism a real possibility. It is also now possible to make statements about factors which contribute to recidivism. The present study utilizes discriminant analysis to make predictions of recidivism.

The juvenile court records of 271 juvenile offenders were reviewed in an effort to predict recidivism with a discriminant analysis methodology. Prediction was attempted on the entire sample at the end of the twelve-month follow-up period and on that portion of the sample not placed in a residential setting following evaluation at the end of the same follow-up period. Both of the derived discriminant functions were found to be able to predict recidivism at better than the established change level. They were also found to be able to predict consistently in a cross-validation group. Factors which proved to be important in the prediction of recidivism were the D and K scales from the Mini-Mult MMPI and prior criminality. The implications of the predictive ability of these factors and directions for further research are discussed.

Prediction of Recidivism in Juvenile Offenders Based on Discriminant Analysis[1]

Prediction, one of the traditional aims of science, is of particular importance in the area of crime and delinquency. Society has long demanded means by which criminal behavior could be predicted and intervention systems by which criminal behavior could be controlled. When rehabilitation became an accepted aim of the penal system the prediction of recidivism following treatment or imprisonment also became an important topic of research. Recidivism quickly became the most popular index of program efficacy. The present study will focus on the prediction of recidivism in juvenile offenders.

The original attempt to predict recidivism in juvenile offenders by Sheldon and Eleanor Glueck (1930) entailed the examination of fifty factors for their relationship to recidivism. The prediction table developed for this study successfully predicted both on an individual, case by case, basis and when used for group prediction. This methodology set the stage for the next forty years of research in the prediction of recidivism in juvenile offenders.

Prediction in general has been greatly influenced by the discovery and application of the concepts of expectancy and inverse probability (Glaser, 1955; Meehl, 1954). In essence, these concepts show that the efficacy of any predictive method must be weighed against the chance level of accuracy based on the observed frequency of the criterion. For example, if it is known that only 30% of a given population will recidivate, a prediction that no subject will recidivate will have a 70% hit rate. In order to be useful, any statistical predictive method will have to show an ability to predict at above that 70% level. As is clear in this example, the less frequently a given event

occurs, the more difficult it will be for a prediction methodology to exceed the "chance" prediction level.

In a direct follow-up to the prediction table methodology developed by the Gluecks, Gough, Wenk, and Rozynko (1965) used a weighted based expectancy table along with Minnesota Multiphasic Personality Inventory (MMPI) and California Personality Inventory (CPI) scores to predict the outcome of parole among California Youth Authority offenders. This study was the first which took inverse probability and expectancy into account. Thus, the prediction table was renamed base expectancy table. In summary, the findings of this study showed that each of the three instruments could differentiate recidivists from non-recidivists at the .01 level of significance. In addition, the various combinations of the three did serve to augment predictive power. The base expectancy table was the best single predictor, followed by the CPI and then the MMPI.

Subsequent studies have shown the base expectancy table methodology to be a useful prediction technique (Ganzer and Sarason, 1973; Smith and Lanyon, 1968). However, the relative difficulty of construction of the tables have resulted in group comparison and correlational methods being more widely employed in prediction studies. The correlational method of prediction was introduced to this area of research by Cowden (1966) in a study designed to predict both institutional adjustment and recidivism. Age and ratings of personality, seriousness of offense, and adjustment were all found to be significantly related in the positive direction to recidivism. Because it produces a list of factors related to the criterion for the entire sample, however, individual prediction can not be made. Although other studies employed the correlational technique (Cowden and Pacht, 1967; Mack, 1969), the methodology was more useful as a means of

determining factors related to recidivism rather than for prediction.

Unkovic and Ducsay (1969) introduced somewhat more sophisticated statistical procedures to the prediction of recidivism in juvenile offenders by using a configurational analysis methodology to predict recidivism in boys and girls released from a correctional institution. Chase (1977) used factor analysis along with a stepwise multiple regression in a prediction study based on a sample of deinstitutionalized, male delinquents. Although no definitive conclusions could be drawn from these studies, the findings were consistent with those reported in previous studies and the methodologies, though complex, were judged to be useful. The use of factor analysis and multiple regression analysis brought research on the prediction of recidivism to the next step beyond the base expectancy table methodology.

An examination of the results of these studies of prediction show that age and adjustment to treatment program appear to be the most consistently predictive variables (Cowden, 1966; Ganzer & Sarason, 1973; Unkovic & Ducsay, 1969). In nearly every study in which they were considered, non-recidivists were older and better able to make a successful adjustment to a treatment program than were recidivists. Because the sex and race factors were so rarely considered, the review of their usefulness as predictors was inconclusive. However, in the few studies where it was analyzed, race appeared to be an effective predictor. White offenders tended to be non-recidivists. Of course, the confounds of a variable such as race are considerable. Overall, any kind of rating by staff proved to be a poor predictor. Also, most psychological tests were not very useful as predictors. The Gough, Wenk, and Rozynko (1965) study, which found both the MMPI and the CPA to be strong predictors, is the

primary exception to that finding. Contrary to what might have been expected, the various factors related to prior criminality showed mixed results as predictors. It must be considered that in the studies which make up this body of literature, there was great variation in methodology, subject population, factors considered, and statistical analyses. That even two factors emerged as consistent, is somewhat remarkable.

The present study represents an attempt to predict recidivism among juvenile offenders with a discriminant analysis methodology. Two published reports of the use of discriminant analysis in the prediction of recidivism were reviewed. Brown, D'Agistino, and Craddick(1978) used the discriminant analysis technique to predict recidivism in adult parolees. They found the procedure to show accurate classification at the 76 percent level and judged it to be a superior classification tool. Alumbaugh, Crigler and Dightman (1978) compared discriminant functions to multiple regression and factor analysis for their relative predictive ability on a sample of juvenile offenders. On the basis of the number of hits versus misses for each technique on two comparison samples, the discriminant analysis proved superior to the other methods. While research on the predictive ability of the discriminant analysis is just beginning to emerge, it does seem to hold considerable promise. The logic of the technique is relatively easily understood, it apparently compares quite favorably to other techniques of prediction, and it readily allows for prediction in applied settings

Method

Subjects

The records of 271 male and female juvenile offenders who were referred

to the Southwestern Juvenile Diagnostic Center, Memphis, Tennessee, for evaluation were reviewed. All of the subjects were referred by the Juvenile Court of Memphis and Shelby County, Tennessee, from January 1977 to March, 1979. The subjects ranged in age from 12 to 16 years. The Southwestern Juvenile Diagnostic Center routinely performs evaluations at the request of the Juvenile Court to aid in disposition decisions. Of the original 271 cases, 43 were randomly designated for a cross-validation group leaving 228 in the classification sample.

Cases were selected for inclusion based on the following criteria: (1) Age less than 17 at the time of evaluation. (2) Evaluation battery which included at least the Mini-Mult form of the Minnesota Multiphasic Personality Inventory (Mini-Mult MMPI) (Kincannon, 1968) and either the Wechsler Intelligence Scale for Children - Revised (WISC-R) or the Wechsler Adult Intelligence Scale (WAIS). (3) Measured Full Scale Intelligence of at least 70. All cases in the specified time period which met the criteria were included. Table 1 presents the sample population broken down on the basis of demographic variables.

Discriminant Analysis

The discriminant analysis technique (Cooley & Lohnes, 1971; Klecka, 1975) is designed to discriminate, statistically, between two or more known groups by the formation of linear combinations of discriminating variables. These linear combinations, known as discriminant functions, serve to analyze and classify data.

The discriminant variables examined in the present study made up the standard Southwestern Juvenile Diagnostic Center evaluation. Data was collected on the following discriminant variables for each subject:

(1) Age in months

(2) Sex

(3) Race

(4) Family make-up measured by defining an intact family as one which included both a biological mother and father, all other situations were defined as broken families

(5) Family income in thousands

(6) School grade placement relative to age

(7) Full Scale IQ, Verbal IQ, and Performance IQ as measured by the WISC-R or WAIS.

(8) The individual scales from the Mini-Mult MMPI

(9) Delinquency (Dq) special MMPI scale developed for the prediction of delinquent behavior (Hathaway & Monachesi, 1957)

(10) Total number of Juvenile Court charges prior to evaluation

(11) Criminality rating of prior charges determined by assigning weights to offenses based on the maximum sentence for the offense according to Tennessee Code for adult crimes.

(12) Average criminality of prior charges derived by dividing the criminality rating by the number of prior charges.

Procedure

By reviewing the Juvenile Court records of each case, the number of juvenile charges were recorded for a twelve month follow-up period. Because the juveniles who were placed in any type of residential setting following evaluation would have significantly less opportunity to continue delinquent careers and because the answer to the question, "What are the chances of recidivism

if this child is not placed" seemed to be most important to the court; the discriminant analysis was performed on two sets of data. In the first set, the entire sample of 228 cases was included. In the second set, those cases which were placed after evaluation were deleted from the sample. This manipulation left 164 cases in the second analysis.

Results

Analysis 1 - Entire Sample at Twelve Months

Table 2 shows that the discriminant function produced in Analysis 1, the analysis of the entire sample for the twelve month follow-up period, was able to correctly classify 61.25% of the cases. The chance level for this analysis, that is the percentage of cases correctly classified if all cases were predicted to be nonrecidivists, was 51.00%. Analysis 1, then, can be considered useful for the prediction of recidivism in this sample.

Analysis 2 - Sample Not Placed At Twelve Months

Analysis 2 represents the discriminant analysis performed on the sample not placed after evaluation for the entire twelve-month follow-up period. It can be seen in Table 3 that there were more recidivists than non-recidivists in this analysis. The discriminant function produced in the analysis classified cases at far better than the chance level of 56.10% when chance was defined as predicting recidivism for all subjects. Thus, Analysis 2 can also be considered a useful predictive tool.

Discriminant Variables

An examination of the variables which were included in the discriminant functions shows some interesting patterns. Both the D scale and the K scale of the Mini-Mult were included in both discriminant functions. Non-recidivists

tended to score higher on the D scale and lower on the K scale than did recidivists.

Prior criminality and average prior criminality, two of the three measures related to the subjects' previous delinquent records, were also included in the discriminant functions considered. Their contributions, however, were different. In Analysis 1 non-recidivists were found to have a higher average prior criminality ratings than recidivists. In Analysis 2, non-recidivists were shown to have a lower prior criminality rating than did recidivists.

Cross-Validation Sample

The classification functions derived from the analyses were checked with the cross-validation group. Table 4 shows a summary of the results of the cross-validation analyses for both Analysis 1 and Analysis 2. It can be seen that the percentage of cases correctly classified in the check of the classification function for the entire sample was 62.79%. This is essentially equal to and not significantly different from the 61.25% correctly classified in Analysis 1. The portion of the cross-validation group not placed after evaluation, 23 subjects, was also classified and the results compared to the results of Analysis 2. It can be seen from Table 4 that the percentage correctly classified in the cross-validation group, 63.64%, was again essentially equal to the 64.02% correctly classified in Analysis 2.

Discussion

The discriminant analysis methodology provided moderate predictive ability when applied to this sample with these particular discriminant variables entered into analysis. It does appear that the procedure was able to classify cases at above the established chance level in both of the analyses. These

classification systems were able to predict from 60 to 65 percent of the cases correctly and that level was shown to be consistently attainable in the cross-validtion sample. However, the error rates of 35 to 40 percent must be improved upon if they are to be useful in making placement decisions for juvenile offenders.

The discriminant analysis procedure itself can do no less than to maximally separate the groups on the basis of the discriminant variables available for analysis. The obtained percentage of cases correctly classified, then, can be attributed to either differences between the two groups or to the quality of the discriminant variables used. It can not be attributed to the discriminant analysis methodology.

One of the possible explanations for the failure of this methodology to show better predictive ability is that the population may be, for all practical purposes, homogenous. When it is considered that the youths referred to the Southwestern Juvenile Diagnostic Center are similar at least in the sense that they present disposition problems for Juvenile Court, this explanation seems plausible. There does exist, however, at least one crucial difference between the two groups. The non-recidivists were able to return to the environment in which they first began their delinquent activity and not accumulate further juvenile charges. The recidivists were not, for whatever reason, able to do that. This difference alone implies further differences between the groups. Another possible explanation for only moderate predictive ability is the quality of the discriminant variables. An analysis of the relative usefulness of each of the discriminant variables included in the present analyses is relatively simple because that analysis is a part of the discriminant analysis procedure.

It seems clear, since IQ was not included in either of the discriminant functions, that intellectual level is not a useful predictor for this population. Also, race was not found to be an important distinction between non-recidivists in either of the analyses. While age did enter into the discriminant function produced in Analysis 2, it was not found to be as important as might have been expected from the review of the existing literature. Sex and family make-up also appeared in only one of the discriminant functions. The other demographic variables, family income and grade placement relative to age were not included in either of the discriminant functions.

Certain of the scales from the Mini-Mult form of the MMPI were found to be predictive. In general, previous research had shown the MMPI to be of little help in predicting recidivism in juvenile offenders. However, it should be noted that all of the previously reviewed work with the MMPI was based on the entire inventory. The degree to which the Mini-Mult and the full MMPI are related continues to be open to debate (Newmark, Ziff, Finch, & Kendall, 1978; Poythress & Blaney, 1978).

Specifically, the D and K scales showed some ability to discriminate recidivists from non-recidivists. Non-recidivists tended to score higher on the D scale which is indicative of depression and guilt. The non-recidivists also tended to score lower on the K scale which would indicate that they are, in general, more trusting and open than are the recidivists. It appears, then, that on the basis of the Mini-Mult scores the non-recidivists in this sample were the youths who were more reachable by others and more uncomfortable in their delinquent role.

Prior criminality also emerged from this analysis as an important factor.

The number of prior charges alone, however, did not carry sufficient information to be of use. The seriousness of a youth's prior record as a whole and the average seriousness of each of the prior charges were found to be better predictors. The way in which these two factors seemed to interact is worthy of closer examination. In one of the analyses, it was found that non-recidivists tended to have a lower level of prior criminality. In the other analysis, the non-recidivists tended to have higher average prior criminality. This pattern may be suggested that, in general, the non-recidivists tend to have a history of fewer, but more serious, juvenile charges. While not clearly delineated in the present study, the concept is in keeping with patterns suggested in earlier studies (Cowden, 1966; Glueck & Glueck, 1930; Laulicht, 1963).

To suggest alternative discriminant variables which may be more useful than those included in this analysis is a relatively speculative endeavor. However, there are indications in the literature on juvenile delinquency that certain variables would merit further study. Demographic variables were fairly well covered in the present study, but a few additional factors could be researched. Recently reported work on the etiology of juvenile delinquency (Elliott, Ageton, Canter, 1979) suggests a combination of community and family involvement in the development of delinquent behavior. Thus, the presence in the family of other youths who have been charged with delinquent acts may be a useful predictor. An estimate of the socioeconomic status and of the prevailing crime rate for the neighborhood in which a youth lives may also be of use. Because learning disabilities have been linked rather convincingly with juvenile delinquency (e.g., Dowis, 1977; Mesinger, 1976; and Poremba, 1975), an indication of the presence or absence of learning disability may prove to be a valuable predictor.

There are certain psychological measures which could well be more effective predictors than the ones included in the present study. The California Personality Inventory was judged to be quite useful in one of the studies previously reviewed (Gough, Wenk, Rozynko, 1965), but has not been included in any of the other predictive research. There is also an increasing body of literature which suggests that the Interpersonal Maturity Level (Sullivan, Grant, & Grant, 1957) may have applications in many different aspects of juvenile delinquency (Jesness, 1971; Warren, 1978). The Interpersonal Maturity Level has become an accepted typological system for juvenile offenders and, like the CPI, has not been included in any of the published research on the prediction of recidivism. Of course, any number of psychological measures which may effectively differentiate recidivists from non-recidivists could be suggested. The CPI and the Interpersonal Maturity Level, however, seem to have already been well-researched in other contexts related to delinquency. Their inclusion in future work on the prediction of recidivism in juvenile offenders seems warranted.

It is further suggested that agencies which are engaged in the evaluation of juvenile offenders conduct ongoing research into the effectiveness with which the information obtained from their evaluations can discriminate recidivists from non-recidivists. Beyond determining an intellectual level and screening for severe emotional or personality disturbances, the purpose of any evaluations ordered by the juvenile justice system is to predict the ability of a given youth to function outside of a correctional or psychiatric facility. Recidivism is one of the strongest indices of that type of functioning. Therefore, the prediction of recidivism must certainly be seen as a primary purpose of an evaluation of a juvenile offender.

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Table 1

Demographic Breakdown of Sample

Demographic Variable		Analysis Group (n = 228)	Cross-Validation Group (n = 43)
Age in Years	12	15	1
	13	16	3
	14	54	12
	15	66	10
	16	77	17
Sex	Male	165	34
	Female	63	9
Race	White	92	21
	Black	136	22

Table 2

Summary of Classification From Analysis 1

Classification Function Coefficients

Variable	Non-recidivists	Recidivists
Sex	11.06827	10.26918
Family	8.52133	8.84439
K	1.76725	1.97704
D	.74785	.65527
Pa	-.02851	.08626
Ma	2.32544	2.44169
Average Prior Criminality	3.03432	2.79840
Constant	-33.77754	-34.36046

Prediction Results

Actual Group	Number of Cases	Predicted Group Membership Non-recidivists	Recidivists
Non-recidivists	138	92	46
Recidivists	133	59	74

Percent of Cases Correctly Classified: 61.25%

Chance Level: 51.00%

Table 3

Summary of Classification From Analysis 2

Classification Function Coefficients

Variable	Non-recidivists	Recidivists
Age	.89082	.87580
K	-.01828	.13556
Hs	-1.27880	-1.05375
D	2.17326	1.99188
Pd	-.21079	-.07566
Prior Criminality	.06466	.12564
Constant	-85.43039	-84.90987

Prediction Results

Actual Group	Number of Cases	Predicted Group Membership Non-recidivists	Recidivists
Non-recidivists	72	41	31
Recidivists	92	28	64

Percent of Cases Correctly Classified: 64.02%

Chance Level: 56.10%

Table 4

Prediction Results from Cross-Validation Samples

Analysis 1

Actual Group	Number of Cases	Predicted Group Membership Group 0	Group 1
Group 0	26	17	9
Group 1	17	7	10

Percent of Cases Correctly Classified: 62.79%
Chance Level: 60.46%
Percent Correctly Classified in Analysis 1: 61.25%
Chance Level for Analysis 1: 51.00%

Analysis 2

Actual Group	Number of Cases	Predicted Group Membership Group 0	Group 1
Group 0	13	6	7
Group 1	10	2	8

Percent of Cases Correctly Classified: 63.64%
Chance Level: 59.09%
Percent Correctly Classified in Analysis 2: 64.02%
Chance Level for Analysis 2: 56.10%

Group 0 = Non-recidivists
Group 1 = Recidivists